What is claimed is:

1.   A single-mode optical fiber suitable for a WDM (Wavelength Division Multiplexing) system, comprising:

(a) a first core region positioned in the center of cross section and having a radius r_1 from the center and a relative refractive index difference $\triangle_1$;

(b) a second core region surrounding the first core region and having a radius r_2 from the center and a relative refractive index difference $\triangle_2$;

(c) a third core region surrounding the second core region and having a radius r_3 from the center and a relative refractive index difference $\triangle_3$; and

(d) a clad region surrounding the third core region and having a radius r_4 from the center and a relative refractive index difference $\triangle_4$,

(e) wherein the radii of the regions have a relation of $r_1 < r_2 < r_3 < r_4$, and the relative refractive index differences of the regions have relations of $\triangle_1 > \triangle_2$, and $\triangle_2 < \triangle_3$;

(here, $\triangle_1(\%)=[(n_1-n_c)/n_c]\times 100$, $\triangle_2(\%)=[(n_2-n_c)/n_c]\times 100$, $\triangle_3(\%)=[(n_3-n_c)/n_c]\times 100$, n_1: a reflective index of the first core region, n_2: a reflective index of the second core region, n_3: a reflective index of the third core region, n_c: a reflective index of the clad region)

(f) wherein the optical fiber uses a wavelength region from 1460 to 1625 nm, and has a dispersion value of 0.1 to 3.0 ps/nm-km at 1460 nm, 3.0 to 5.5 ps/nm-km at 1550 nm, and 4.5 to 8.0 ps/nm-km at 1625 nm.

2.   The single-mode optical fiber according to claim 1,

wherein the optical fiber has a positive dispersion slope in the wavelength band

for use.

5   3.   The single-mode optical fiber according to claim 2,

wherein the optical fiber has a dispersion slope of 0.023 to 0.05 ps/nm-km^2 at

1550 nm.

4.   The single-mode optical fiber according to claim 3,

10   wherein the optical fiber has an effective section area of 35 to 50μm^2 at 1550

nm.

5.   The single-mode optical fiber according to claim 3,

wherein the optical fiber has an effective section area of 35 to 50μm^2 at 1460

15   nm.

6.   The single-mode optical fiber according to claim 4 or 5,

wherein the optical fiber has a cutoff wavelength of 1450 nm or below.

20   7.   The single-mode optical fiber according to claim 4 or 5,

wherein a zero-dispersion wavelength is located at 1460 nm or below.

8.   The single-mode optical fiber according to claim 4 or 5,

wherein the optical fiber has a dispersion value of 0.3 to 2.4 ps/nm-km at 1460

nm.

9.   The single-mode optical fiber according to claim 4 or 5,

5   wherein the optical fiber has a dispersion value of 3.2 to 5.2 ps/nm-km at 1550

nm.

10.   The single-mode optical fiber according to claim 4 or 5

wherein the optical fiber has a dispersion value of 4.8 to 7.7 ps/nm-km at 1625

10   nm.

11.   The single-mode optical fiber according to claim 10,

wherein a bending loss is 0.5dB or less at 1625 nm under the condition of a

bending radius of 30mm, 100turns.

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12.   The single-mode optical fiber according to claim 1,

i) wherein the first core region has a radius $r_1=3.05\pm0.6\mu m$ and a relative

refractive index difference $\triangle_1(\%)=0.54\pm0.03\%$;

ii) wherein the second core region has a radius $r_2=5.38\pm0.6\mu m$ and a refractive

20   index difference $\triangle_2=-0.20\pm0.03\%$; and

iii) wherein the third core region has a radius $r_3=9.96\pm0.6\mu m$ and a specific

refractive index difference $\triangle_3=0.07\pm0.03\%$.

13.   The single-mode optical fiber according to claim 1,

i) wherein the first core region has a radius r_1=3.05$\pm$0.6µm and a relative refractive index difference $\triangle_1$(%)= 0.55$\pm$0.03%;

ii) wherein the second core region has a radius r_2=5.75$\pm$0.6µm and a relative

5   refractive index difference $\triangle_2$ = -0.18$\pm$0.03%; and

iii) wherein the third core region has a radius r_3=10.79$\pm$0.6µm and a relative refractive index difference $\triangle_3$ = 0.09$\pm$0.03%.

14.   The single-mode optical fiber according to claim 1,

10   i) wherein the first core region has a radius r_1=3.12$\pm$0.6µm and a relative refractive index difference $\triangle_1$(%)= 0.53$\pm$0.03%;

ii) wherein the second core region has a radius r_2=5.56$\pm$0.6µm and a relative refractive index difference $\triangle_2$ = -0.23$\pm$0.03%; and

iii) wherein the third core region has a radius r_3=9.92$\pm$0.6µm and a relative

15   refractive index difference $\triangle_3$ = 0.10$\pm$0.03%.

15.   The single-mode optical fiber according to claim 1,

i) wherein the first core region has a radius r_1=3.24$\pm$0.6µm and a relative refractive index difference $\triangle_1$(%)= 0.48$\pm$0.03%;

20   ii) wherein the second core region has a radius r_2=5.72$\pm$0.6µm and a relative refractive index difference $\triangle_2$ = -0.17$\pm$0.03%; and

iii) wherein the third core region has a radius r_3=8.54$\pm$0.6µm and a relative

refractive index difference $\triangle_3 = 0.15 \pm 0.03\%$.

16.   The single-mode optical fiber according to claim 1,

i) wherein the first core region has a radius $r_1 = 3.37 \pm 0.6\mu m$ and a relative

5   refractive index difference $\triangle_1(\%) = 0.50 \pm 0.03\%$;

ii) wherein the second core region has a radius $r_2 = 5.77 \pm 0.6\mu m$ and a relative

refractive index difference $\triangle_2 = -0.25 \pm 0.03\%$; and

iii) wherein the third core region has a radius $r_3 = 9.35 \pm 0.6\mu m$ and a relative

refractive index difference $\triangle_3 = 0.14 \pm 0.03\%$.

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17.   The single-mode optical fiber according to claim 1,

i) wherein the first core region has a radius $r_1 = 3.18 \pm 0.6\mu m$ and a relative

refractive index difference $\triangle_1(\%) = 0.51 \pm 0.03\%$;

ii) wherein the second core region has a radius $r_2 = 6.18 \pm 0.6\mu m$ and a relative

15   refractive index difference $\triangle_2 = -0.19 \pm 0.03\%$; and

iii) wherein the third core region has a radius $r_3 = 8.65 \pm 0.6\mu m$ and a relative

refractive index difference $\triangle_3 = 0.14 \pm 0.03\%$.

18.   A single-mode optical fiber suitable for a WDM (Wavelength Division

20   Multiplexing) system, comprising:

(a) a first core region positioned in the center of cross section and having a

radius r_1 from the center and a relative refractive index difference $\triangle_1$;

(b) a second core region surrounding the first core region and having a radius r_2 from the center and a relative refractive index difference $\triangle_2$;

(c) a third core region surrounding the second core region and having a radius r_3 from the center and a relative refractive index difference $\triangle_3$; and

5   (d) a clad region surrounding the third core region and having a radius r_4 from the center and a relative refractive index difference $\triangle_4$,

(e) wherein the radii of the regions have a relation of $r_1 < r_2 < r_3 < r_4$, and the relative refractive index differences of the regions have relations of $\triangle_1 > \triangle_2$, and $\triangle_2 < \triangle_3$;

10   (here, $\triangle_1(\%)=[(n_1-n_c)/n_c] \times 100,$ $\triangle_2(\%)=[(n_2-n_c)/n_c] \times 100,$ $\triangle_3(\%)=[(n_3-n_c)/n_c] \times 100$, n_1: a reflective index of the first core region, n_2: a reflective index of the second core region, n_3: a reflective index of the third core region, n_c: a reflective index of the clad region)

(f) wherein the optical fiber uses wavelength region from 1460 to 1625 nm, and

15   has a dispersion value of 0.1 to 3.0 ps/nm-km at 1460 nm, 3.0 to 5.5 ps/nm-km at 1550 nm, and 4.5 to 8.0 ps/nm-km at 1625 nm;

(g) wherein a dispersion slope at 1550 nm is 0.023 to 0.05 ps/nm-km^2;

(h) wherein an effective section area at 1550 nm is 35 to 50μm^2.

20   19.   The single-mode optical fiber according to claim 18,

wherein the optical fiber has an effective section area of 35 to 50μm^2 at 1460 nm.

20.   The single-mode optical fiber according to claim 18,

wherein the optical fiber has a cutoff wavelength of 1450 nm or below.

21.   The single-mode optical fiber according to claim 18,

5   wherein a zero-dispersion wavelength is located at 1460 nm or below.

22.   The single-mode optical fiber according to claim 18,

wherein the optical fiber has a dispersion value of 0.3 to 2.4 ps/nm-km at 1460

nm.

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23.   The single-mode optical fiber according to claim 18,

wherein the optical fiber has a dispersion value of 3.2 to 5.2 ps/nm-km at 1550

nm.

15   24.   The single-mode optical fiber according to claim 18,

wherein the optical fiber has a dispersion value of 4.8 to 7.7 ps/nm-km at 1625

nm.

25.   The single-mode optical fiber according to claim 18,

20   wherein a bending loss is 0.5dB or less at 1625 nm under the condition of a

bending radius of 30mm, 100turns.

26.   An optical transmission line in which the single-mode optical fiber

defined in any of claims 1 to 18 is adopted.

27.   An optical transmission system in which the optical transmission line

defined in claim 26 is adopted in at least a part of an optical transmission path.

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